Simplicial surfaces in GAP

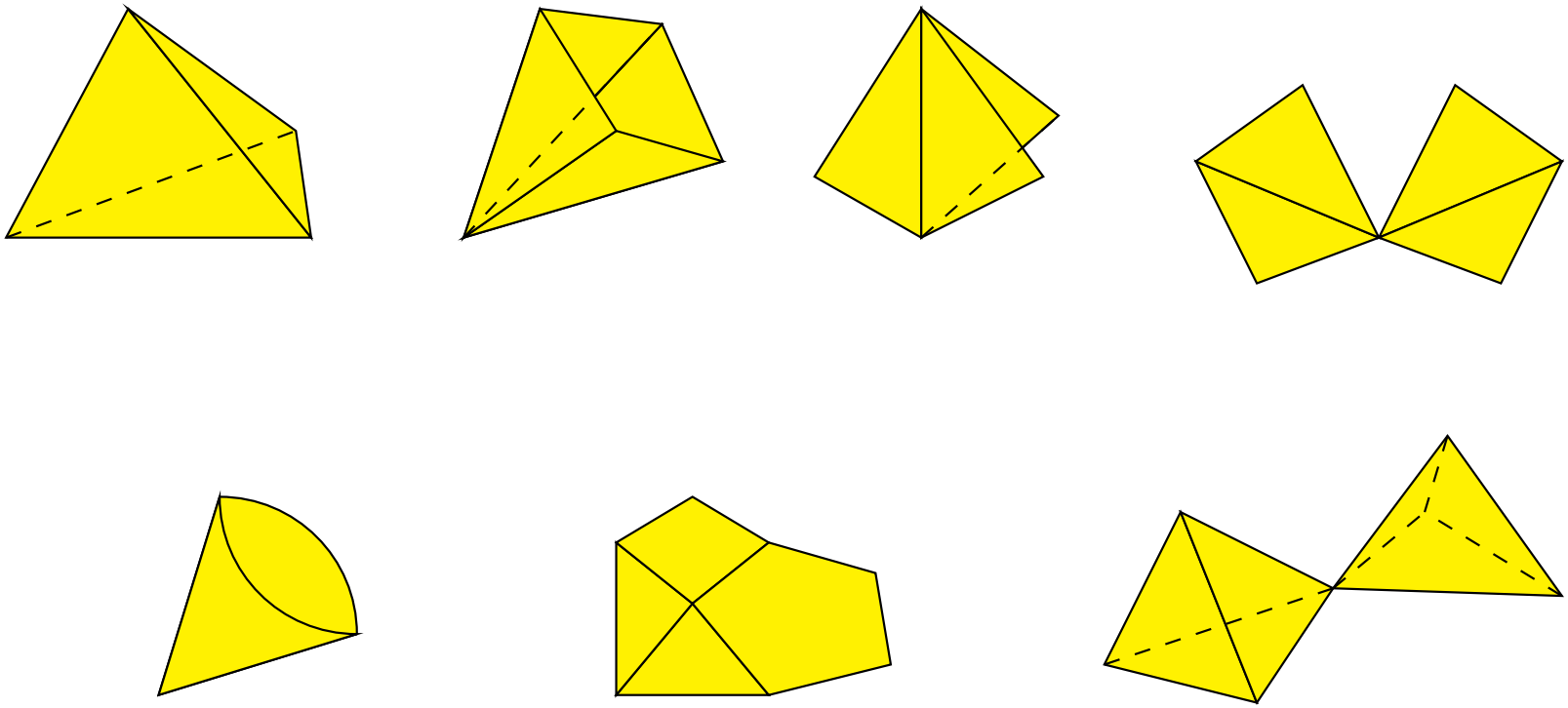
Markus Baumeister

??.08.2017

1. General polygonal complexes by incidence geometry
2. Edge colouring and group properties
3. Abstract folding

Motivation

Goal: simplicial surfaces (and generalisations) in GAP



$\rightsquigarrow$ examples of **polygonal complexes**

No embedding

We do not work with embeddings (mostly)

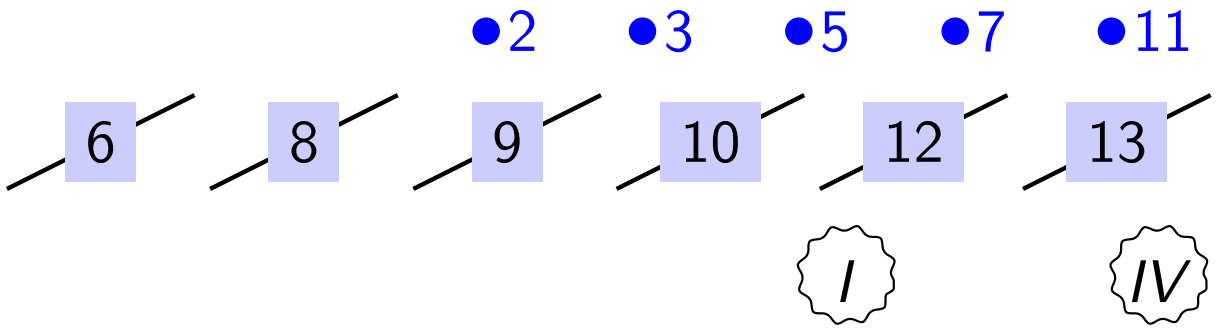
- is very hard to compute
- if often unknown for an abstractly constructed surface
- is different from *intrinsic structure*

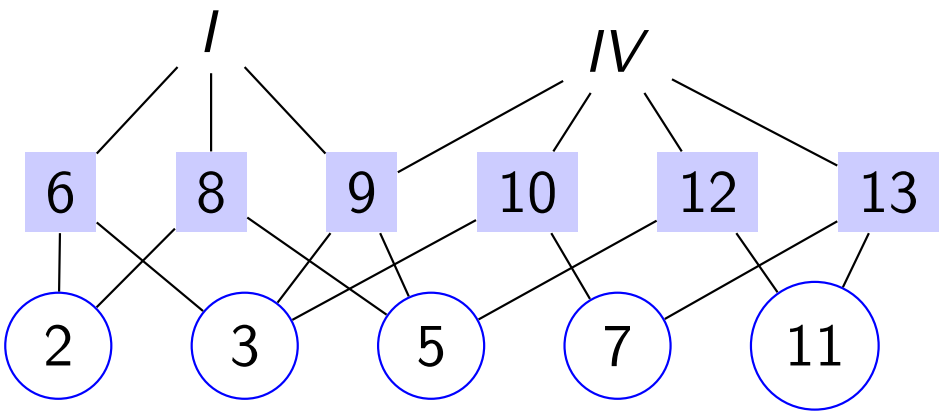
$\Rightarrow$ lengths and angles are not important

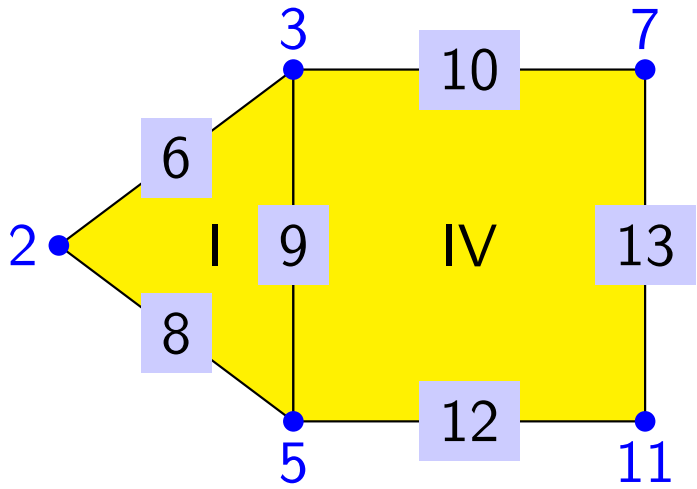
$\rightsquigarrow$ incidence structure is intrinsic

Incidence structure

- set of vertices $\mathcal{V}$
- set of edges $\mathcal{E}$
- set of faces $\mathcal{F}$
- transitive relation $\subseteq (\mathcal{V} \times \mathcal{E}) \uplus (\mathcal{V} \times \mathcal{F}) \uplus (\mathcal{E} \times \mathcal{F})$



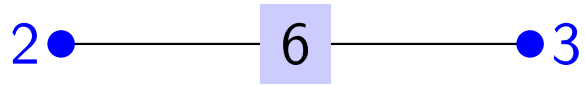




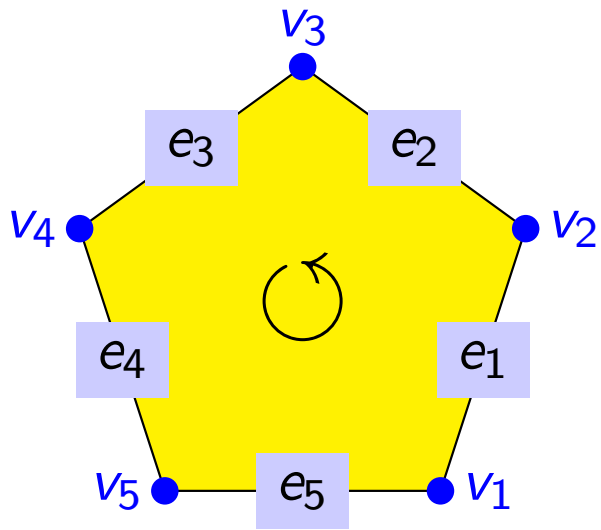
Polygonal complexes

A **polygonal complex** is a two–dimensional incidence structure of vertices, edges and faces, such that:

1. Every edge has exactly two vertices.



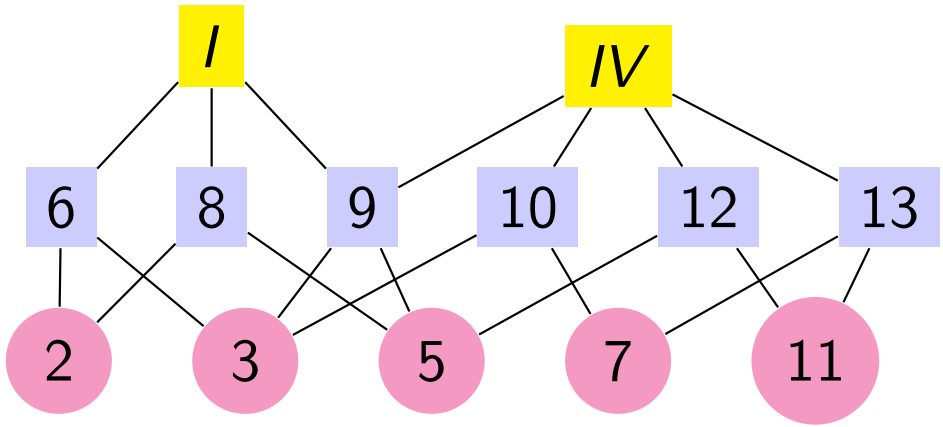
2. Every face is a polygon.



3. Every vertex lies in an edge
4. Every edge lies in a face

Isomorphism testing

Incidence geometry allows "easy" isomorphism testing. Incidence structure can be interpreted as a coloured graph:



$\rightsquigarrow$ reduce to graph isomorphism problem
Solved by NautyTracesInterface (by Gutsche, Niemeyer, Schweitzer)

1. General polygonal complexes by incidence geometry

2. Edge colouring and group properties

3. Abstract folding

1. General polygonal complexes by incidence geometry
2. Edge colouring and group properties
3. Abstract folding